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Hubble Space Telescope Observations of the Draco Dwarf Spheroidal

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The color-magnitude (CM) diagram of the Draco dwarf spheroidal was first studied by Baade & Swope (1961). In addition to finding a general similarity to the CM-diagrams of metal-poor globular clusters, they also detected the anomalous Cepheids and broad giant branch which are characteristic of dwarf spheroidals. The best ground-based CCD CM diagrams of the Draco dwarf spheroidal to date have been presented by Stetson, Vandenberg, & McClure (1985) and Carney & Seitzer (1986, hereafter CS86). Here we describe the first results of an *HST* program to investigate the stellar population of this galaxy.

Photometry was carried out on Wide Field/Planetary Camera 2 images using a combination of aperture photometry and ALLFRAME PSF-fitting photometry (Stetson 1994), depending on local crowding conditions. The resulting F814W vs F606W - F814W color-magnitude (CM) diagram is shown in Figure 1. The magnitudes have been dereddened assuming $E(B-V) = 0.03$ using the absorptions tabulated by Holtzman *et al.* (1995) for stars of K5 spectral type.

Completeness tests were carried out by adding ≈ 100 stars at a time with F606W - F814W = 1 to each of the F606W and F814W images. The results of these tests reveal that the 50% completeness level occurs at F814W ≈ 26.2, and that the photometric uncertainties are ± 0.11 mag rms at F814W = 25.

The morphology in Figure 1 above the turnoff is very similar to that found by Stetson *et al.* (1985) and CS86. Owing to the superior resolution afforded by the *HST* data, we are able to extend the main sequence 2 magnitudes fainter than these ground-based studies. The turnoff region is well resolved and reveals that the bluest main-sequence stars have F606W-F814W ≈ 0.4. We see very few blue stragglers, though this may not be inconsistent with CS86 given that our total field area is only about one sixth of theirs. Unlike CS86, we see no evidence for distinct multiple turnovers; the stars in the WFPC2 field appear to be approximately coeval.

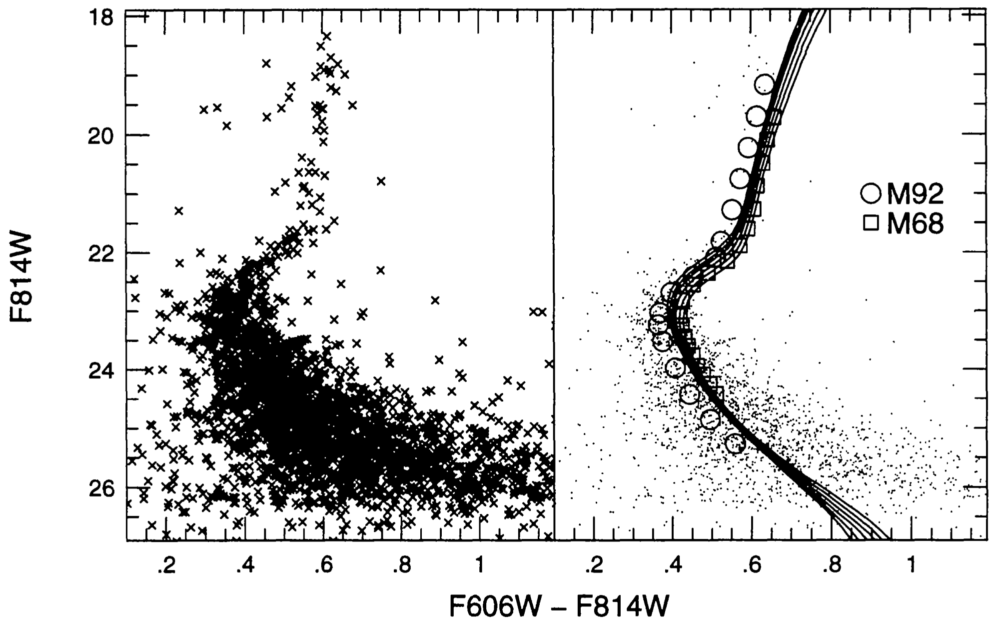

Figure 1. HST CM diagram of the Draco dwarf spheroidal. The CM diagram is compared with fiducial sequences for the metal-poor globular clusters M68 and M92 from Walker (1994) and Heasley & Janes (1996) in the right-hand panel. Superimposed are Worthey models of age 18 Gyrs and spanning metallicities of [Fe/H] = -2.2 to [Fe/H] = -1.2. The globular cluster sequences have been transformed from V and I to F606W and F814W using the transformation coefficients given by Holtzman *et al.* 1995.

Using isochrones generated by Worthey (1994) and a free-ranging χ^2-minimization technique, we find that the best-fitting track corresponds to [Fe/H] ≈ -2.0 and an age of 18 Gyr. This agrees well with a value of [Fe/H] = -2.15 measured by Aaronson & Mould (1985).

A calibration-independent method for measuring relative ages has been described by Vandenberg, Bolte, & Stetson (1990). Measuring the difference in color between the turnoff and the giant branch (which is relatively insensitive to metallicity but is a monotonic function of age), we find that Draco, M68, and M92 are coeval to within 1-2 Gyr.

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